

## ECOSYSTEM STATUS INDICATORS

### *Seabirds*

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### **Fishery Interactions**

#### Fisheries bycatch.

This section provides information on trends in seabird bycatch by fishery and by species or species group through 2003. The data from 2004 will be included at a later date, after data are compiled and prepared for distribution. Those data will also be available at the AFSC seabird/fishery interaction website during fall of 2005 at <http://www.afsc.noaa.gov/refm/reem/Seabirds/Default.htm>

Bycatch summarized here is reported by the species or reporting groups developed in consultation with the U.S. Fish and Wildlife Service Region 7 (Anchorage, Alaska). The definitions for species or group codes used in the detailed seabird bycatch tables at the end of this section are:

STAL - Short-tailed albatross

LAAL - Laysan's albatross

BFAL - Black-footed albatross

NOFU - Northern fulmar

Gull - Unidentified gulls (herring gulls, glaucous gulls, glaucous-winged gulls)

SHWR - Unidentified shearwaters (unidentified dark shearwaters, sooty shearwaters, short-tailed shearwaters)

Unidentified Tubenose - Unidentified procellariiformes (albatrosses, shearwaters, petrels)

Alcid - Unidentified alacids (guillemots, murre, puffins, murrelets, auklets)

Other - Miscellaneous birds (could include loons, grebes, storm-petrels, cormorants, waterfowl, eiders, shorebirds, phalaropes, jaeger/skuas, red-legged kittiwakes, black-legged kittiwakes, terns)

Unidentified ALB - Unidentified albatrosses (could include short-tailed albatrosses, Laysan's albatrosses, black-footed albatrosses)

*Bycatch in Longline Fisheries:* Longline, or hook and line, fisheries in Alaskan waters are demersal sets and target groundfish or halibut. There are no observer coverage requirements for the halibut fleet. Information reported here are for demersal groundfish longline fisheries only. Longline fisheries in the BSAI are typically undertaken by vessels that are larger, stay at sea longer (up to 30 days), have onboard processing abilities, target Pacific cod (*Gadus macrocephalus*) and Greenland turbot (*Reinhardtius hippoglossoides*), use auto-bait systems, and deploy up to 55,000 hooks per day (Melvin et al. 2001). Conversely, longline vessels in the GOA typically are smaller, have shorter trip lengths (6 days), deliver bled fish on ice to shoreside processing plants, target sablefish (*Anoplopoma fimbria*), use tub or hand bait gear, and deploy up to 10,500 hooks per day (Melvin et al. 2001).

Between 1993 and 2003 the average annual bycatch in the combined BSAI and GOA longline fisheries was 13,551 seabirds (12,619 and 932 respectively; Table 26). Over this period the average annual

bycatch rates were 0.071 and 0.024 birds per 1,000 hooks in the BSAI and GOA, respectively. The period previous to 1998 was typified by large inter-annual variation in seabird bycatch, even with the implementation of the first generation of seabird avoidance regulations in 1997 (Figure 98). Beginning in 1998, seabird bycatch has trended downward. In 2002 many freezer-longliners fishing in the BSAI adopted the recommendations from studies completed by Melvin et al. (2001). Paired streamer lines meeting specific performance standards had proven to be very effective in reducing seabird bycatch during this study. NMFS completed revisions to seabird avoidance regulations in February 2004. Among other requirements, vessels larger than 55 feet length over all must use paired streamer lines except in certain weather conditions.

In the BSAI the annual bycatch of seabirds has been substantially reduced to the current numbers of about 5,000 birds (Figure 98). While seabird bycatch increased in 2003 over 2002, the rate remained constant while effort continued an upward trend (Figures 98 and 99). Note that a total of 3,835 seabirds were taken in BSAI longline fisheries in 2002 (Table 27). This represents a steady reduction over the previous few years, and is a 6-fold decrease in the total number of birds taken from the high of over 24,000 birds in 1998. In the same time frame there has been a 7-fold reduction in the bycatch rate from 0.14 to 0.02 seabirds per 1,000 hooks (Table 26).

In the GOA seabird bycatch was also higher in 2003 (632 birds) than in 2002 (259 birds) (Table 28). A very large increase in overall effort in 2003 was matched with a slight increase in overall seabird bycatch in the GOA. However, with steady increases in overall effort each year since 1998, the bycatch has decreased steadily from that high year. This is the first year since 1998 that bycatch was higher than the previous year. Bycatch in 2002 was the lowest yet recorded, and represented a 6-fold decrease from the high of 1,634 birds in 1996. The increase in seabird bycatch in 2003 causes concern, but with new regulations implemented for the 2004 season we are hopeful that the numbers will continue the downward trend observed since 1998 for both bycatch and the bycatch rate in the GOA (Figures 98-100).

Seabird bycatch in the BSAI and GOA longline fleets is linked to a variety of factors that have resulted in large inter-annual variation (Dietrich 2003). Some of these factors include food availability, environmental conditions, breeding success, and population levels. Other factors include fleet or vessel-specific factors and the effectiveness of mitigation measures. Seabird bycatch in 2002 was the lowest recorded for the longline fleet. Efforts by the longline fleet may have contributed substantially to the observed reduction, although no analysis has been completed to ascertain the contribution of various factors. In 2003 seabird bycatch in the BSAI increased by nearly 40% over 2002, while the bycatch rate remained fairly constant (0.019 vs 0.018 in 2002). The increased bycatch was likely due, in part, to a 28% increase in effort. However, other factors may also have been at work, given the reduction in bycatch between 1998 and 2002 of 84% while effort increased over this time by 23%. We also note that the seabird bycatch more than doubled in the GOA, while effort increased by about 1.5. Exploration of what contributed most to this upswing in bycatch is beyond the scope of this report but does represent an interesting area for further research. Efforts have been undertaken by NMFS, Washington Sea Grant, and industry associations to complete outreach activities and work with vessel owners and operators to further reduce bycatch. With these actions and the implementation of new regulations in 2004 that require paired streamer lines for all longline vessels over 60 feet the downward trend will hopefully continue.

The species composition for seabird bycatch in the BSAI longline fishery is 59 percent fulmars, 20 percent gull species, 12 percent unidentified seabirds, 4 percent albatross species, 3 percent shearwater species, and 2 percent 'all other' species. Species composition in the GOA longline fishery is: 46 percent fulmars, 34 percent albatrosses, 12 percent gull species, 5 percent unidentified seabirds, 2 percent shearwater species, and less than 1 percent 'all other' species.

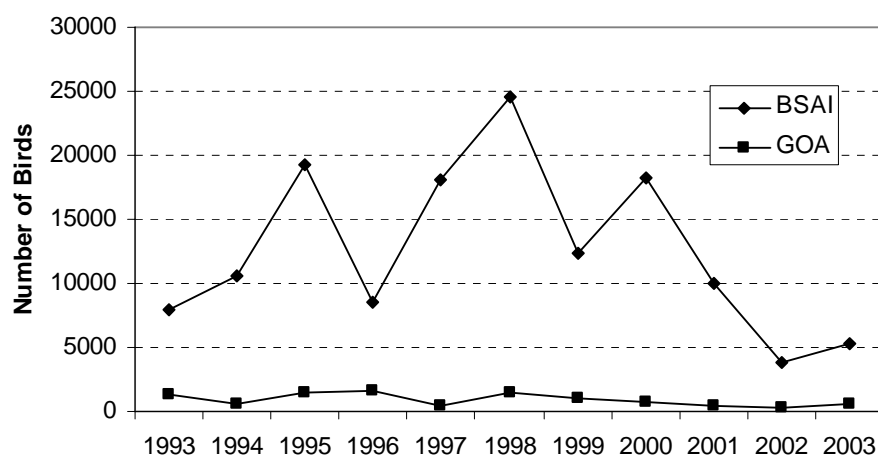


Figure 98. Estimated seabird bycatch in the BSAI and GOA groundfish longline fisheries of the Alaskan EEZ, 1993 to 2003.

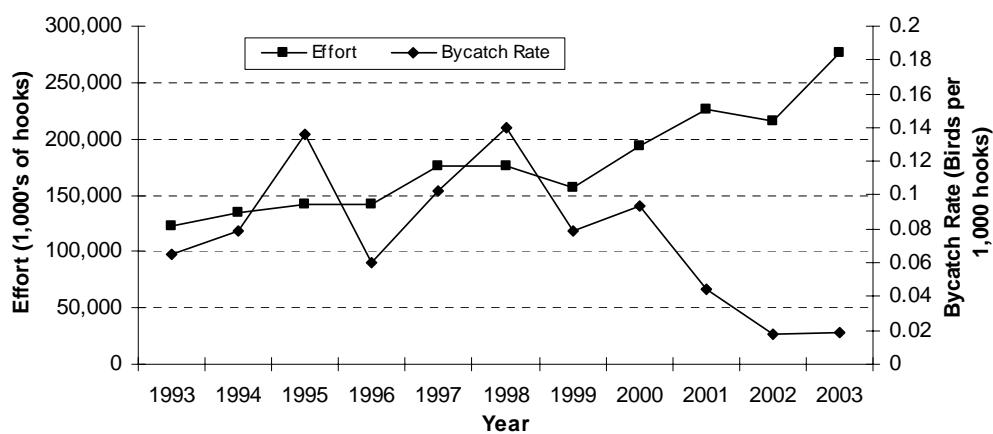


Figure 99. BSAI groundfish longline effort and seabird bycatch rate, 1993 through 2003.

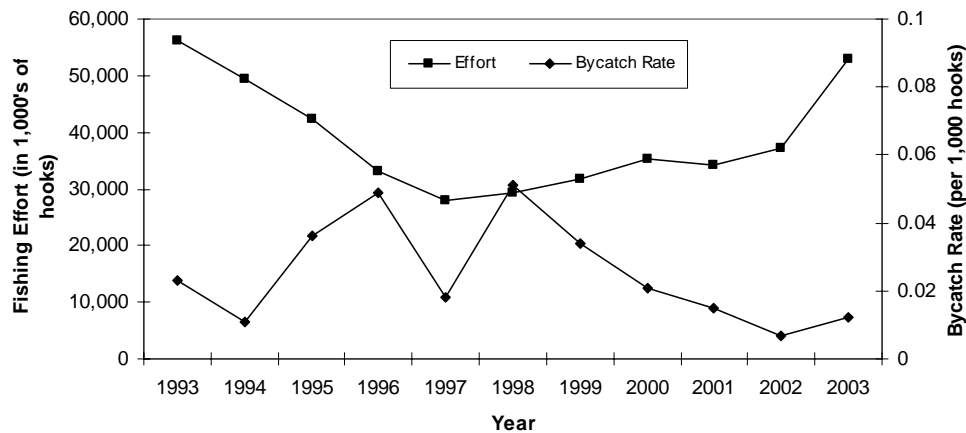


Figure 100. GOA groundfish longline effort and seabird bycatch rate, 1993 through 2003.

*Pot:* Seabird bycatch from groundfish pot fishing has traditionally been very limited. The overall average bycatch in this fishery, 1993 through 2003, is 55 seabirds. That trend continues, with only 10 birds observed taken in 2003, extrapolating up to an estimated 153 total mortalities (Table 29).

*Trawl:* On trawl vessels only, observers use either whole haul, partial haul, or basket sampling to record prohibited species bycatch and determine the species composition of the haul. Observers are often required to use 2 sample types in a single haul, in order to best sample for either of these goals. Observers have been instructed to use the largest sample available when monitoring for seabird bycatch. Unfortunately, that has not always occurred. This would not be a problem for estimation purpose, as observers record their sample size for each species in their sample, except that the great majority of hauls do not have any seabird bycatch. NMFS did not require observers to record the sample size when no birds were observed, so it is unknown which sample size was used to monitor for seabird bycatch in these hauls. Thus, it has been necessary to calculate two alternative sets of estimates of seabird bycatch for trawlers based on the largest (alternative1) and smallest (alternative2) sizes of sampling effort recorded for fish species (Figure 101 and Table 30). In each of these two alternative calculation methods, a separate ratio estimator was used to bind the results of the catch ratios and variances of data from the three different sample sizes into arbitrary equal samples which were then inflated upwards to the total catch effort of the NMFS blend program. It is not known which of the 2 estimates is more accurate. Seabird bycatch on trawl vessels probably lies somewhere between them. If the majority of observers had been able to use their largest sample size to monitor for seabird bycatch, as instructed, then the lower of the two estimates more closely represents seabird bycatch on the trawl fleet (Table 30). This issue has been resolved for data collections beginning in the 2004 season, where the sample size used to monitor for seabirds will be noted whether a bird was taken or not. Estimates are provided for 1998 through 2003 only due to the way the commercial catch data were organized prior to that. Northern fulmars are again the most common species taken, constituting more than 53% of the seabird bycatch.

Another source of mortality for seabirds on trawl vessels are the cables that run between net monitoring devices and the vessel, or the trawl door cables themselves. To date, only anecdotal information is available, so the extent of the mortality from this cause is uncertain. Special projects were also designed and implemented for observers during 2004 and will be expanded for the 2005 fishing season. We are currently developing estimates on total effort and will use the 2004 and 2005 observer data to better characterize interaction rates and mortalities. A collaborative project has been started between industry,

the Alaska Fisheries Science Center, the University of Washington, and the USFWS to determine and test mitigation measures to reduce seabird interactions with trawl sonar transducer cables.

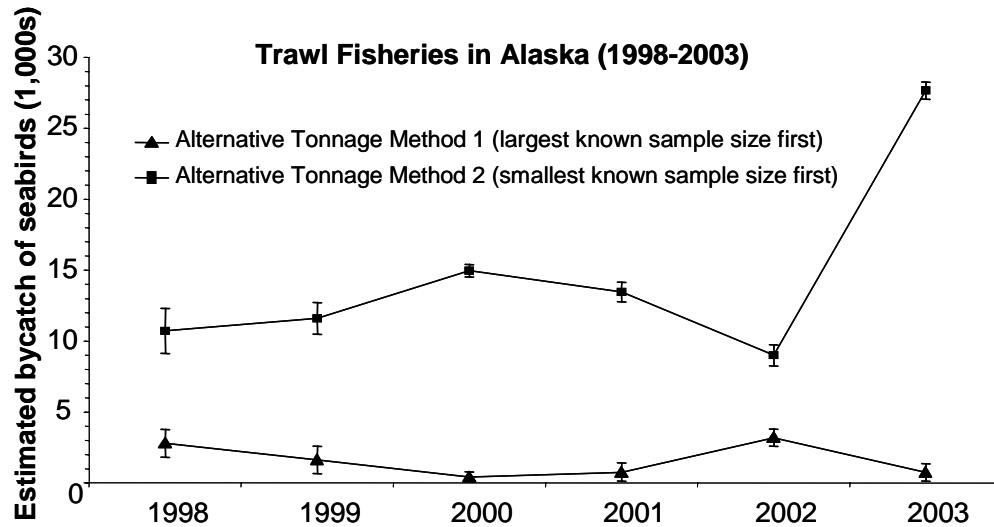


Figure 101. Seabird bycatch in Alaskan groundfish trawl fisheries (combined) using two alternate estimation methods incorporating potential sample sizes used while monitoring for seabirds in observer samples.

*Pot:* Seabird bycatch from groundfish pot fishing has traditionally been very limited. The overall average bycatch in this fishery, 1993 through 2003, is 55 seabirds. That trend continues, with only 10 birds observed taken in 2003, extrapolating up to an estimated 153 total mortalities.

*Species Composition:* Depending on which trawl estimate is used (see above), longline gear accounted for 94 or 65 percent of the total average annual seabird bycatch while trawl gear accounted for either 6 or 35 percent. Pot gear was less than 1 percent in all cases. The higher percentage of trawl bycatch coincides with the alternate trawl estimation methods as described above (Figure 101). Based on the average annual estimates of seabirds observed taken in groundfish longline fisheries from 1993 to 2003, 93 percent of the longline seabird bycatch was caught in the BSAI and 7 percent in the GOA. Also of note, the bycatch rates in the BSAI are higher than in the GOA (Figures 99 and 100).

#### Seabird bycatch trends by species or species groups.

When summarizing overall mortality for each species, all fisheries combined, the numbers are confounded by the need to produce two alternate estimates within the trawl fleet due to the sample size notation issue (see above, Figure 101 and Table 30). Detailed numbers by species or species groups can be found at [www.afsc.noaa.gov/refm/seabirds](http://www.afsc.noaa.gov/refm/seabirds).

*Short-tailed Albatross:* In the NMFS analysis of 1993 to 2003 observer data, only three of the albatrosses taken during observer sampling were identified as short-tailed albatrosses (all were from the BSAI longline fishery). Two additional short-tailed albatross were recovered by observers from outside of their sample period. The analysis of 1993 to 2003 data resulted in an average estimate of one short-tailed

albatross being taken annually in the BSAI groundfish hook-and-line fishery and zero short-tailed albatross being estimated taken annually in the GOA groundfish hook-and-line fishery. The incidental take limit established in the USFWS biological opinions on the effects of the hook-and-line (longline) fisheries on the short-tailed albatross is based on the actual reported takes and not on extrapolated estimated takes. There is currently an incidental take established for the trawl fishery as well. No short-tailed albatross have been recovered from that fishery, either through direct observer sampling or through anecdotal observations. The endangered short-tailed albatross population is currently increasing. The total population is estimated at about 1,900 (Greg Balogh, U.S. Fish and Wildlife Service, pers. comm.).

*Laysan Albatross:* Laysan albatross bycatch peaked in 1998 at about 2,000 birds and has been trending substantially downward since then to less than 150 birds in 2002 (Figure 102). The rise in Laysan albatross bycatch from 2002 to 2003 was driven both by the BSAI longline bycatch, and by birds taken in the trawl fishery. In the combined groundfish fisheries (longline and trawl), the 2003 estimated bycatch mortality of Laysan albatross was 432 birds when the higher estimate for the trawl fleet is used (Table 30). Using the lower trawl estimate yields 365 birds. In 2002 the numbers were 105 and 49, respectively. The cause of this rise in bycatch is currently unknown, but might be attributed to the normal inter-annual variations seen in the past. When analyzed, the 2004 estimates should indicate whether efforts to reduce albatross mortalities through the use of mitigation measures have been successful. Efforts currently underway include implementation of regulations requiring improved seabird mitigation measures on longliners, coordination with the industry to complete vessel-specific bycatch reduction work, and continued research in both the longline and trawl fisheries on methods to deter birds from interacting with commercial fishing gear. The Laysan albatross population was estimated at 874,000 by BirdLife International ([www.birdlife.org](http://www.birdlife.org)) in 2003, but that number includes only breeding pairs. The U.S. Fish and Wildlife Service is currently engaged in a population assessment. A bycatch level of 500 birds per year represents 0.06% of the Birdlife International population estimate. However, Laysan albatross bycatch is not constrained only to the groundfish fisheries in Alaska. They may be taken by demersal halibut and pelagic tuna and swordfish longline fisheries in the North Pacific as well.

*Black-footed Albatross:* No black-footed albatross have been recorded by observers in the Alaskan trawl fleets from 1998-2003, either within the observer sample or from an interaction with trawl cables. The bycatch of black-footed albatross is from the longline fisheries, and has been extremely variable over time (Figure 103). Most bycatch occurs in the GOA longline fisheries. After the peak of nearly 700 black-footed albatross taken in 1996, the bycatch has undergone a steady downward trend. Numbers rose again in 2003, due to a slight increase in bycatch rates coupled with a larger increase in overall effort in the GOA. Implementation of seabird avoidance regulations and other activities will hopefully reduce black-footed albatross bycatch. The USFWS was petitioned on 28 September 2004 to list the black-footed albatross as endangered under the U.S. Endangered Species Act, citing the decision by the IUCN to classify the species as endangered on the Red List in 2003 ([www.redlist.org](http://www.redlist.org)). World population estimates range from 275,000 to 327,753 individuals (Brooke 2004, NMFS 2004a). Bycatch in the Alaskan demersal groundfish fleet represent 0.07% of the lower of these population estimates. Note that the groundfish fishery is only one source of bycatch for this species throughout its range.

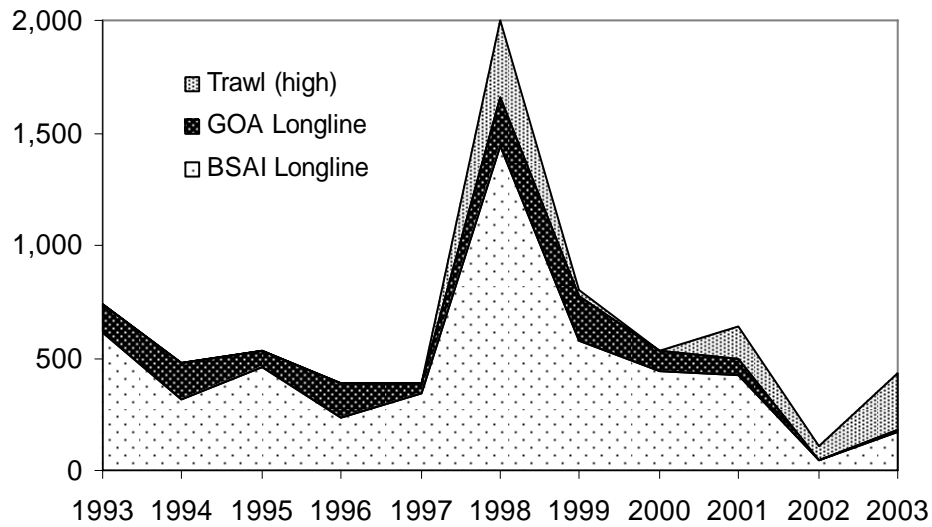


Figure 102. Combined bycatch in Alaskan groundfish fisheries for Laysan albatross, 1993 through 2003. Data for trawl fisheries begins in 1998.

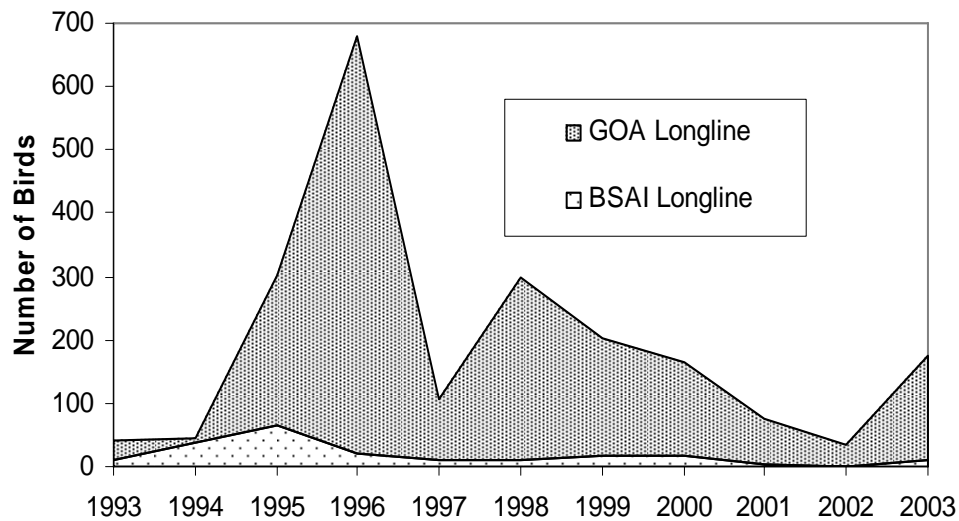


Figure 103. Combined bycatch in Alaskan groundfish fisheries for black-footed albatross, 1993 through 2003.

*Unidentified Albatross:* Not all albatross are identified by observers. This is due in some cases to inexperience with seabird identification, but is most likely due to birds that are not retrieved on board and thus cannot be examined closely by observers. Observers are currently instructed to return albatross to port if they cannot identify them. Seabird identification for observers focuses on albatross identification characteristics, and species identification materials are provided to observers. These efforts have reduced the number of unidentified albatross recorded. The annual estimate over the past 5 years is about 8 unidentified albatross, which likely represent a sample size of one or two individual birds per year recorded by observers as unidentified.

*Northern Fulmar:* The northern fulmar is the most frequent species taken among all fisheries combined. Discussion of northern fulmar bycatch is especially confounded by the need to provide two sets of possible bycatch numbers for the trawl fleet. Figure 104 a and b represents northern fulmar bycatch combined for all fisheries, with longline and pot represented from 1993 onward and trawl included since 1998. The alternate methods for the trawl fleet are noted by a low estimate (Figure 104a) and a high estimate (Figure 104b). Total bycatch of fulmars in the longline fisheries peaked in 1999 and dropped substantially since, with a slight increase in the last year. Bycatch in the trawl fleet is difficult to judge at this time, given the need to report estimates using these alternate methods. While the higher estimate procedure results in almost 30,000 mortalities, that number should be used with great caution. The actual number may be much lower than that estimate. Additional analyses of these data are necessary. Conversely, those numbers do not include mortalities from interactions with trawl cables. Note also that some components of the trawl industry are working closely with NMFS and Washington Sea Grant to develop mitigation measures for seabirds. The Northern fulmar population was previously estimated at 2.1 million birds by the USFWS in 1998. A bycatch rate of 30,000 birds is 1.4% of this population estimate.



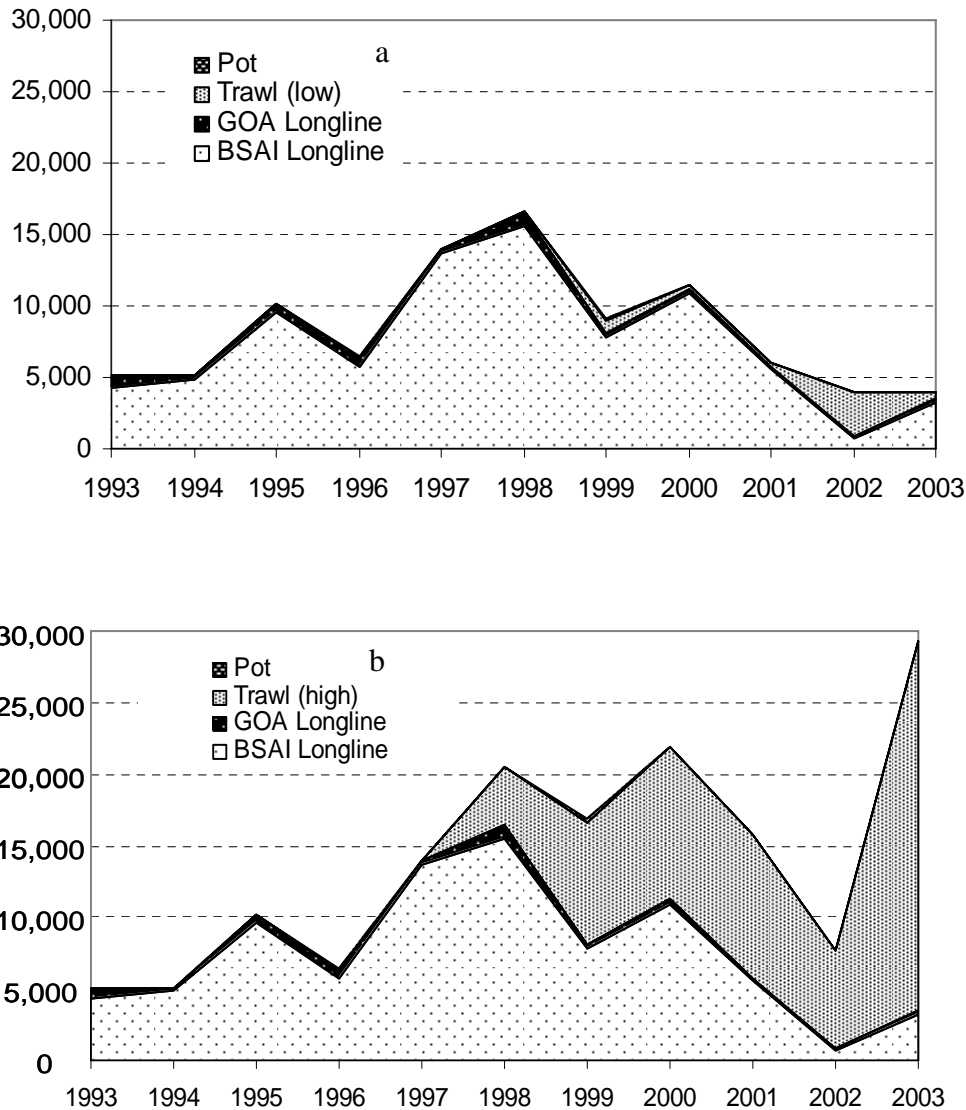


Figure 104. Estimated northern fulmar bycatch in North Pacific groundfish fisheries, using low (a) and high (b) estimation procedures for the trawl fishery. Data from the trawl fishery prior to 1997 are not included.

*Shearwater species:* Observers are not required to identify sooty and short-tailed shearwaters to species. They record them as unidentified dark shearwater. Other shearwaters occur rarely in the Bering Sea and Gulf of Alaskan, so identification materials have not been provided. Any occurrence of shearwaters other than sooty or short-tailed would likely be recorded in one of the unidentified categories. Using the trawl estimation method that results in a higher estimate, the annual average bycatch, 1999 through 2003, from all sources is 1,566. Using the lower estimate from the trawl fleet would yield an average of 482 birds.

Total shearwater bycatch peaked at 3,500 in 2001 and has decreased to less than 500 in 2003. These numbers are negligible when compared to population estimates that over 50 million for these two species.

*Gull species:* Observers are not asked to identify gulls, other than kittiwakes, to species. The combined annual bycatch for gull species, 1999-2003, using the high trawl estimate, is 2,915. The BSAI longline fishery currently accounts for 90% of this bycatch.

#### Population Effects of Bycatch

Effects of the bycatch in groundfish fisheries off Alaska of albatross and other seabirds at the population level are uncertain (Melvin et al. 2001). With the exception of the short-tailed albatross, data on the number, size and geographic extent and mixing of seabird populations are poorly understood. Seabird mortality in Alaska groundfish fisheries represents only a portion of the fishing mortality that occurs, particularly with the albatrosses. Mortality of black-footed and Laysan albatrosses occurs also in the Hawaiian pelagic longline fisheries and may be assumed to occur in other North Pacific pelagic longline fisheries conducted by Japan, Taiwan, Korea, Russia, and China (Brothers et al. 1999, Lewison and Crowder 2003). Assessments of overall mortality, which fisheries contribute to that mortality, and what effect these fisheries have on populations from both mortality and food provisioning aspects is an area where research is needed. The lack of good population assessments for many of these species creates barriers in moving forward with these studies, although the USFWS is currently engaged in improved population assessments for the albatross species.

#### Competition for food resources

Seabirds and commercial fisheries may compete in several ways. Competition could be direct, if both are targeting forage fish, or indirect when fisheries affect prey availability in other ways. Additionally, commercial fisheries may provide food resources to seabird species that then compete directly with other seabird species. These factors may apply in the open ocean for non-breeders as well as near colonies during the breeding season.

Most of the groundfish fisheries occur between September and April (NMFS 2001), and do not overlap temporally with the main seabird breeding period that occurs from May through August (DeGange and Sanger 1987, Hatch and Hatch 1990, Dragoo et al. 2000, 2003). Seabird attachment to the colony is most likely to overlap with fisheries effort during the early (pre and early egg-laying) and late (late chick-rearing and fledging) portion of their breeding season. Juvenile birds, generally on their own and not experienced foragers, would also be most abundant at sea during the fall fisheries. Groundfish fisheries might affect prey availability indirectly around seabird colonies even though they do not overlap with the seabird's breeding season. These potential effects include boat disturbance, alteration of predator-prey relations among fish species, habitat disturbance, or direct take of fish species whose juveniles are consumed by seabirds (see seabird section in Ecosystem Considerations chapter, NPFMC 2000, for review).

If seabirds are in competition with other upper-trophic level consumers, it suggests that the seabirds might, at a local scale, also impact fish populations. Overall consumption of fish biomass by seabirds is generally low, estimated at < 4 % (Livingston 1993); however, seabirds may impact fish stocks within foraging range of seabird colonies during summer (Springer et al. 1986, Birt et al. 1987). Fifteen to eighty percent of the biomass of juvenile forage fish may be removed by birds each year near breeding colonies (Wiens and Scott 1975, Furness 1978, Springer et al. 1986, Logerwell and Hargreaves 1997). Consequently, seabirds may therefore be vulnerable to factors that reduce forage fish stocks in the vicinity of colonies (Monaghan et al. 1994).

These issues need to be explored further in the North Pacific. Direct assessments or modeling of these interactions are needed to gain a better understanding of the various competitive aspects for seabirds and commercial groundfish fisheries in Alaskan waters.

#### Provision of food resources

Commercial fishing vessels operate in one of several modes. Fish are caught and delivered to a mothership or shoreside processor, or fish are caught and processed on board the vessel. The latter vessels are known as catcher/processor vessels and they provide a steady stream of processed fish (offal) overboard. Seabirds feed on this resource, and are attracted to vessels that process at sea. The interplay between the temporal and spatial availability of offal, the total amounts discharged by vessels, and how much use of this food resource seabirds use is not well documented in Alaskan waters. Generally, vessels that have been steadily processing fish will have hundreds of birds in attendance, composed primarily of northern fulmars, but also including kittiwakes, shearwaters, gulls, albatross, and other species.

There have been a series of regulations implemented over the years that affect both discards and offal. How these regulations have changed the availability of discards and offal to seabirds and how those changes have affected seabirds are unknown. This is an area that NMFS staff expect to explore, in collaboration with other researchers, starting in 2004.

Table 26. Annual estimates, by area, of total fishery effort, total numbers and bycatch rates of seabirds taken in Alaskan groundfish demersal longline fisheries.

| Year                            | Effort<br>(No. of Hooks<br>in 1,000s) | Number of<br>Birds | 95%<br>Confidence<br>Bounds | Bycatch Rate<br>(Birds per 1,000<br>Hooks) | Percent of<br>Hooks<br>Observed |
|---------------------------------|---------------------------------------|--------------------|-----------------------------|--|---------------------------------|
| Bering Sea and Aleutian Islands |                                       |                    |                             |  |                                 |
| 1993                            | 123,232                               | 7,975              | 6,981-8,968                 | 0.065                                      | 24.5                            |
| 1994                            | 134,954                               | 10,637             | 9,608-11,666                | 0.079                                      | 24.5                            |
| 1995                            | 141,779                               | 19,214             | 17,853-20,576               | 0.136                                      | 24.2                            |
| 1996                            | 141,810                               | 8,526              | 7,641-9,412                 | 0.060                                      | 23.8                            |
| 1997                            | 176,594                               | 18,063             | 16,491-19,634               | 0.102                                      | 22.6                            |
| 1998                            | 175,530                               | 24,602             | 22,779-26,425               | 0.140                                      | 23.5                            |
| 1999                            | 157,319                               | 12,418             | 10,950-13,887               | 0.079                                      | 25.0                            |
| 2000                            | 192,994                               | 18,191             | 16,599-19,783               | 0.094                                      | 22.8                            |
| 2001                            | 226,185                               | 9,992              | 9,027-10,958                | 0.044                                      | 21.0                            |
| 2002                            | 216,197                               | 3,835              | 3,328-4,342                 | 0.018                                      | 22.5                            |
| 2003                            | 276,327                               | 5,351              | 4,705-5,997                 | 0.019                                      | 22.6                            |
| BSAI Average Annual Estimates   |                                       |                    |                             |  |                                 |
| 1999-2003                       | 213,804                               | 9,958              | 9,455-10,460                | 0.047                                      | 22.6                            |
| 1993-2003                       | 178,447                               | 12,619             | 12,246-12,991               | 0.071                                      | 23.2                            |
| Gulf of Alaska                  |                                       |                    |                             |  |                                 |
| 1993                            | 56,300                                | 1,309              | 1,056-1,563                 | 0.023                                      | 10.2                            |
| 1994                            | 49,452                                | 532                | 397-668                     | 0.011                                      | 4.9                             |
| 1995                            | 42,357                                | 1,519              | 1,302-1,736                 | 0.036                                      | 12.7                            |
| 1996                            | 33,195                                | 1,634              | 1,206-2,062                 | 0.049                                      | 10.8                            |
| 1997                            | 28,047                                | 514                | 338-689                     | 0.018                                      | 10.0                            |
| 1998                            | 29,399                                | 1,498              | 795-2,200                   | 0.051                                      | 8.1                             |
| 1999                            | 31,895                                | 1,093              | 812-1,375                   | 0.034                                      | 8.6                             |
| 2000                            | 35,345                                | 751                | 402-1,101                   | 0.021                                      | 6.5                             |
| 2001                            | 34,216                                | 512                | 311-713                     | 0.015                                      | 7.8                             |
| 2002                            | 37,166                                | 259                | 114-404                     | 0.007                                      | 9.3                             |
| 2003                            | 53,066                                | 632                | 268-995                     | 0.012                                      | 6.5                             |
| GOA Average Annual Estimates    |                                       |                    |                             |  |                                 |
| 1999-2003                       | 38,338                                | 649                | 523-775                     | 0.017                                      | 7.6                             |
| 1993-2003                       | 39,131                                | 932                | 831-1,033                   | 0.024                                      | 8.6                             |

Table 27. Estimated total incidental catch of seabirds by species or species groups in Bering sea and Aleutian islands demersal groundfish longline fisheries, 1993-2003. Values in parentheses are 95% confidence bounds.

| Year | Actual No. Taken <sup>a</sup> | STAL        | BFAL           | LAAL                   | NOFU                      | Gull                   | SHWR                 | Unid. Tube-noses | Alcid         | Other         | Unid. ALB        | Unid. Seabird          | Total                     |
|------|-------------------------------|-------------|----------------|------------------------|---------------------------|------------------------|----------------------|------------------|---------------|---------------|------------------|------------------------|---------------------------|
| 1993 | 1,942                         | 0           | 11<br>(4-21)   | 617<br>(458-777)       | 4,259<br>(3,416-5,103)    | 853<br>(576-1,130)     | 64<br>(22-107)       | 0                | 15<br>(4-30)  | 4<br>(1-10)   | 352<br>(188-517) | 1,799<br>(1,399-2,200) | 7,975<br>(6,981-8,968)    |
| 1994 | 2,700                         | 0           | 37<br>(7-66)   | 311<br>(218-404)       | 4,829<br>(4,188-5,470)    | 1,734<br>(1,297-2,172) | 675<br>(487-864)     | 350<br>(226-475) | 4<br>(1-13)   | 4<br>(1-11)   | 76<br>(43-109)   | 2,615<br>(1,956-3,274) | 10,637<br>(9,608-11,666)  |
| 1995 | 4,832                         | 0           | 66<br>(26-107) | 463<br>(267-660)       | 9,628<br>(8,613-10,643)   | 3,954<br>(3,274-4,634) | 330<br>(225-434)     | 475<br>(253-697) | 4<br>(1-11)   | 45<br>(16-74) | 38<br>(19-57)    | 4,211<br>(3,489-4,933) | 19,214<br>(17,853-20,576) |
| 1996 | 2,002                         | 4<br>(1-13) | 20<br>(5-48)   | 234<br>(156-313)       | 5,677<br>(4,858-6,496)    | 1,493<br>(1,238-1,747) | 487<br>(246-728)     | 14<br>(4-26)     | 46<br>(9-103) | 49<br>(13-86) | 60<br>(31-90)    | 442<br>(326-558)       | 8,526<br>(7,641-9,412)    |
| 1997 | 4,123                         | 0           | 9<br>(2-22)    | 343<br>(252-433)       | 13,611<br>(12,109-15,122) | 2,755<br>(2,276-3,234) | 300<br>(154-445)     | 173<br>(103-243) | 0             | 7<br>(2-16)   | 14<br>(3-28)     | 852<br>(519-1,185)     | 18,063<br>(16,491-19,634) |
| 1998 | 5,850                         | 8<br>(2-18) | 9<br>(2-21)    | 1,441<br>(1,078-1,804) | 15,533<br>(13,873-17,192) | 4,413<br>(3,732-5,093) | 1,131<br>(936-1,326) | 21<br>(5-38)     | 53<br>(24-82) | 48<br>(15-81) | 4<br>(1-11)      | 1,941<br>(1,584-2,297) | 24,602<br>(22,779-26,425) |
| 1999 | 3,293                         | 0           | 18<br>(4-34)   | 576<br>(478-674)       | 7,843<br>(6,477-9,209)    | 2,209<br>(1,817-2,601) | 449<br>(358-540)     | 414<br>(150-679) | 4<br>(1-10)   | 47<br>(12-85) | 0                | 859<br>(551-1,167)     | 12,418<br>(10,950-13,887) |
| 2000 | 3,868                         | 0           | 16<br>(5-33)   | 441<br>(320-562)       | 10,941<br>(9,503-12,378)  | 4,541<br>(3,894-5,188) | 556<br>(414-697)     | 85<br>(44-125)   | 5<br>(1-14)   | 16<br>(4-30)  | 15<br>(3-30)     | 1,576<br>(1,166-1,985) | 18,191<br>(16,599-19,783) |
| 2001 | 1,987                         | 0           | 4<br>(1-12)    | 425<br>(304-547)       | 5,517<br>(4,701-6,332)    | 2,459<br>(2,044-2,873) | 457<br>(337-578)     | 94<br>(49-139)   | 2<br>(1-6)    | 33<br>(6-61)  | 5<br>(1-14)      | 997<br>(698-1,295)     | 9,992<br>(9,027-10,958)   |

Table 27 continued.

| Year                    | Actual No. Taken <sup>a</sup> | STAL       | BFAL          | LAAL             | NOFU                   | Gull                   | SHWR             | Unid. Tube-noses | Alcid        | Other         | Unid. ALB     | Unid. Seabird          | Total                     |
|-------------------------|-------------------------------|------------|---------------|------------------|------------------------|------------------------|------------------|------------------|--------------|---------------|---------------|------------------------|---------------------------|
| 2002                    | 877                           | 0          | 0             | 48<br>(19-77)    | 701<br>(582-819)       | 2,523<br>(2,040-3,006) | 154<br>(95-213)  | 17<br>(5-34)     | 10<br>(2-23) | 16<br>(4-32)  | 5<br>(1-14)   | 361<br>(259-462)       | 3,835<br>(3,328-4,342)    |
| 2003                    | 1,123                         | 0          | 10<br>(2-23)  | 167<br>(77-257)  | 3,204<br>(2,655-3,754) | 1,346<br>(1,029-1,662) | 287<br>(209-366) | 14<br>(3-38)     | 11<br>(3-22) | 62<br>(24-99) | 0             | 250<br>(177-324)       | 5,351<br>(4,705-5,997)    |
| Average Annual Estimate |                               |            |               |                  |                        |                        |                  |                  |              |               |               |                        |                           |
| 1999-2003               | na                            | 0          | 10<br>(4-16)  | 331<br>(287-376) | 5,641<br>(5,197-6,085) | 2,616<br>(2,408-2,823) | 381<br>(335-427) | 125<br>(70-180)  | 6<br>(2-11)  | 35<br>(22-48) | 5<br>(1-9)    | 808<br>(687-930)       | 9,958<br>(9,455-10,460)   |
| 1993-2003               | na                            | 1<br>(0-3) | 18<br>(12-25) | 461<br>(413-508) | 7,431<br>(7,106-7,756) | 2,571<br>(2,425-2,717) | 445<br>(402-487) | 151<br>(116-186) | 14<br>(7-21) | 30<br>(22-38) | 52<br>(36-68) | 1,446<br>(1,326-1,566) | 12,619<br>(12,246-12,991) |

<sup>a</sup> Actual number taken is the total number of seabirds recorded dead in the observed hauls.

Table 28. Estimated total incidental catch of seabirds by species or species groups in Gulf of Alaska demersal groundfish longline fisheries, 1993-2003. Values in parentheses are 95% confidence bounds.

| Year                    | Actual No. Taken | STAL | BFAL             | LAAL             | NOFU               | Gull             | SHWR          | Unid. Tube-noses | Alcid          | Other       | Unid. ALB        | Unid. Seabird    | Total                  |
|-------------------------|------------------|------|------------------|------------------|--------------------|------------------|---------------|------------------|----------------|-------------|------------------|------------------|------------------------|
| 1993                    | 318              | 0    | 29<br>(9-50)     | 125<br>(62-187)  | 833<br>(615-1,052) | 45<br>(12-77)    | 59<br>(18-99) | 0                | 0              | 3<br>(1-7)  | 3<br>(1-9)       | 213<br>(107-318) | 1,309<br>(1,056-1,563) |
| 1994                    | 126              | 0    | 7<br>(2-16)      | 169<br>(89-250)  | 258<br>(165-351)   | 30<br>(2-81)     | 26<br>(5-54)  | 0                | 0              | 0           | 8<br>(2-18)      | 33<br>(8-66)     | 532<br>(397-668)       |
| 1995                    | 374              | 0    | 236<br>(169-304) | 67<br>(35-99)    | 520<br>(348-692)   | 99<br>(53-145)   | 39<br>(9-69)  | 6<br>(1-16)      | 0              | 3<br>(2-6)  | 376<br>(275-476) | 173<br>(105-240) | 1,519<br>(1,302-1,736) |
| 1996                    | 250              | 0    | 658<br>(455-860) | 154<br>(90-218)  | 668<br>(352-985)   | 121<br>(6-317)   | 14<br>(2-35)  | 0                | 0              | 0           | 0                | 19<br>(3-42)     | 1,634<br>(1,206-2,062) |
| 1997                    | 74               | 0    | 99<br>(32-167)   | 40<br>(5-109)    | 307<br>(164-451)   | 46<br>(14-79)    | 9<br>(2-21)   | 0                | 0              | 0           | 0                | 12<br>(2-30)     | 514<br>(338-689)       |
| 1998                    | 184              | 0    | 289<br>(25-596)  | 217<br>(56-378)  | 922<br>(310-1,533) | 53<br>(14-92)    | 13<br>(3-30)  | 0                | 0              | 0           | 4<br>(1-12)      | 0                | 1,498<br>(795-2,200)   |
| 1999                    | 159              | 0    | 183<br>(70-297)  | 202<br>(123-280) | 277<br>(156-399)   | 358<br>(136-581) | 50<br>(8-93)  | 0                | 0              | 7<br>(1-21) | 0                | 16<br>(4-37)     | 1,093<br>(812-1,375)   |
| 2000                    | 72               | 0    | 148<br>(62-235)  | 93<br>(25-160)   | 297<br>(70-524)    | 179<br>(15-415)  | 0             | 0                | 0              | 0           | 0                | 34<br>(2-102)    | 751<br>(402-1,101)     |
| 2001                    | 45               | 0    | 72<br>(20-124)   | 67<br>(6-128)    | 230<br>(115-344)   | 98<br>(4-244)    | 20<br>(1-58)  | 0                | 6<br>(1-18)    | 0           | 15<br>(1-44)     | 3<br>(1-9)       | 512<br>(311-713)       |
| 2002                    | 51               | 0    | 33<br>(10-57)    | 0                | 129<br>(24-238)    | 83<br>(17-177)   | 0             | 0                | 0              | 0           | 0                | 14<br>(3-30)     | 259<br>(114-404)       |
| 2003                    | 37               | 0    | 166<br>(11-350)  | 12<br>(3-23)     | 260<br>(81-439)    | 58<br>(4-140)    | 0             | 0                | 118<br>(1-369) | 0           | 0                | 18<br>(1-53)     | 632<br>(268-995)       |
| Average Annual Estimate |                  |      |                  |                  |                    |                  |               |                  |                |             |                  |                  |                        |
| 1999-2003               | na               | 0    | 121<br>(72-169)  | 75<br>(50-99)    | 239<br>(168-309)   | 155<br>(80-231)  | 14<br>(2-26)  | 0                | 25<br>(0-76)   | 1<br>(0-5)  | 3<br>(0-9)       | 17<br>(2-34)     | 650<br>(523-1,033)     |
| 1993-2003               | na               | 0    | 175<br>(133-216) | 104<br>(81-127)  | 427<br>(351-504)   | 106<br>(66-146)  | 21<br>(13-29) | 1<br>(0-2)       | 11<br>(0-35)   | 1<br>(0-3)  | 40<br>(27-47)    | 49<br>(34-63)    | 932<br>(831-1,033)     |

Table 29. Estimated total incidental catch of seabirds by species or species groups in the combined Bering Sea and Aleutian Islands and Gulf of Alaska groundfish pot fisheries, 1993–2002. Values in parentheses are 95% confidence bounds.

| Year                    | Actual Number Taken <sup>a</sup> | STAL | BFAL | LAAL | NOFU            | Gull         | SHWR        | Unid. Tubenoses | Alcid         | Other | Unid. ALB | Unid. Seabird | Total           |
|-------------------------|----------------------------------|------|------|------|-----------------|--------------|-------------|-----------------|---------------|-------|-----------|---------------|-----------------|
| 1993                    | 0                                | 0    | 0    | 0    | 0               | 0            | 0           | 0               | 0             | 0     | 0         | 0             | 0               |
| 1994                    | 0                                | 0    | 0    | 0    | 0               | 0            | 0           | 0               | 0             | 0     | 0         | 0             | 0               |
| 1995                    | 6                                | 0    | 0    | 0    | 9<br>(2-23)     | 3<br>(1-10)  | 7<br>(1-20) | 0               | 19<br>(2-55)  | 0     | 0         | 0             | 39<br>(6-79)    |
| 1996                    | 9                                | 0    | 0    | 0    | 80<br>(7-174)   | 0            | 0           | 2<br>(1-6)      | 0             | 0     | 0         | 7<br>(1-19)   | 89<br>(9-183)   |
| 1997                    | 4                                | 0    | 0    | 0    | 14<br>(3-29)    | 0            | 0           | 0               | 9<br>(1-26)   | 0     | 0         | 0             | 23<br>(4-46)    |
| 1998                    | 2                                | 0    | 0    | 0    | 19<br>(1-54)    | 15<br>(1-44) | 0           | 0               | 0             | 0     | 0         | 0             | 33<br>(2-79)    |
| 1999                    | 47                               | 0    | 0    | 0    | 166<br>(71-261) | 0            | 9<br>(1-26) | 14<br>(5-28)    | 0             | 0     | 0         | 0             | 189<br>(91-286) |
| 2000                    | 1                                | 0    | 0    | 0    | 0               | 0            | 0           | 0               | 0             | 0     | 0         | 42<br>(1-122) | 42<br>(1-122)   |
| 2001                    | 3                                | 0    | 0    | 0    | 13<br>(2-33)    | 3<br>(1-8)   | 0           | 0               | 0             | 0     | 0         | 0             | 16<br>(3-36)    |
| 2002                    | 6                                | 0    | 0    | 0    | 18<br>(5-34)    | 0            | 0           | 0               | 0             | 0     | 0         | 3<br>(0-26)   | 21<br>(6-38)    |
| 2003                    | 10                               | 0    | 0    | 0    | 92<br>(8-182)   | 0            | 2<br>(1-4)  | 0               | 59<br>(1-171) | 0     | 0         | 0             | 153<br>(10-296) |
| Average Annual Estimate |                                  |      |      |      |                 |              |             |                 |               |       |           |               |                 |
| 1999-2003               | na                               | 0    | 0    | 0    | 58<br>(31-85)   | 1<br>(0-2)   | 2<br>(0-6)  | 3<br>(1-6)      | 12<br>(0-35)  | 0     | 0         | 9<br>(0-26)   | 84<br>(45-123)  |
| 1993-2003               | Na                               | 0    | 0    | 0    | 37<br>(22-53)   | 2<br>(0-5)   | 2<br>(0-4)  | 1<br>(0-30)     | 8<br>(0-19)   | 0     | 0         | 5<br>(0-13)   | 55<br>(34-76)   |

<sup>a</sup> Actual number taken is the total number of seabirds recorded dead in the observed hauls.



Table 30. Range of estimates of the total incidental catch of seabirds by species or species groups in the combined Bering Sea and Aleutian Islands and Gulf of Alaska groundfish trawl fisheries, 1998–2003.

| Year                    | Actual Number Taken <sup>a</sup> | Estimate Range | STAL | BFAL | LAAL | NOFU   | Gull  | SHWR  | Unid. Tubenoses | Alcid | Other d | Unid. ALB | Unid. Seabird | Total  |
|-------------------------|----------------------------------|----------------|------|------|------|--------|-------|-------|-----------------|-------|---------|-----------|---------------|--------|
| 1998                    | 45                               | low            | 0    | 0    | 135  | 96     | 1,590 | 856   | 1               | 110   | 3       | 0         | 8             | 2,798  |
|                         |                                  | high           | 0    | 0    | 343  | 4,012  | 708   | 1,353 | 163             | 543   | 2,494   | 0         | 1,110         | 10,725 |
| 1999                    | 154                              | low            | 0    | 0    | 8    | 858    | 0     | 82    | 0               | 664   | 2       | 0         | 17            | 1,630  |
|                         |                                  | high           | 0    | 0    | 27   | 8,528  | 0     | 1,149 | 0               | 791   | 85      | 0         | 1,025         | 11,604 |
| 2000                    | 101                              | low            | 0    | 0    | 0    | 298    | 37    | 10    | 2               | 1     | 0       | 0         | 60            | 407    |
|                         |                                  | high           | 0    | 0    | 0    | 10,678 | 114   | 3,086 | 155             | 333   | 0       | 0         | 603           | 14,969 |
| 2001                    | 141                              | low            | 0    | 0    | 8    | 323    | 4     | 329   | 9               | 1     | 3       | 0         | 65            | 741    |
|                         |                                  | high           | 0    | 0    | 150  | 10,022 | 288   | 887   | 1,075           | 68    | 297     | 0         | 681           | 13,468 |
| 2002                    | 69                               | low            | 0    | 0    | 1    | 3,111  | 4     | 4     | 0               | 5     | 9       | 0         | 59            | 3,193  |
|                         |                                  | high           | 0    | 0    | 56   | 6,809  | 71    | 595   | 0               | 878   | 124     | 0         | 475           | 9,008  |
| 2003                    | 78                               | low            | 0    | 0    | 186  | 456    | 52    | 1     | 1               | 49    | 0       | 0         | 1             | 746    |
|                         |                                  | high           | 0    | 0    | 253  | 25,792 | 242   | 127   | 172             | 551   | 0       | 0         | 528           | 27,665 |
| Average Annual Estimate |                                  |                |      |      |      |        |       |       |                 |       |         |           |               |        |
| 1999-2003               | Na                               | low            | 0    | 0    | 41   | 1,009  | 19    | 85    | 2               | 144   | 3       | 0         | 40            | 1,343  |
|                         |                                  | high           | 0    | 0    | 97   | 12,366 | 143   | 1,169 | 280             | 524   | 101     | 0         | 662           | 15,343 |

a Actual number taken is the total number of seabirds recorded dead in the observed haul